IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Sumie SUDA, et al. : Examiner Caitlin A. Fogarty

Serial No. 10/549,753

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for STEEL WIRE FOR HIGH STRENGTH SPRING EXCELLENT IN WORKABILITY AND HIGH STRENGTH SPRING

DECLARATION UNDER 37. C.F.R. 1.132

Commissioner for Patents

Alexandria, VA 22313

Sir:

Now comes Sumie SUDA, a citizen of Amagasaki-shi, Hyogo -ken, Japan, who declares and states:

1. That I graduated from the Faculty of Engineering of Nagoya Institute of Technology in the year 1993.

2. That I have worked in Kobe Steel, Ltd. for 18 years in the field of steel rod and steel wire.

3. SUBJECT MATTER OF EXPERIMENTS

That I have conducted the following experiment to demonstrate the criticality for both ratios ($\sigma_{0.2}/\sigma_B$) and prior austenite grain size numbers as claimed in Claim 1.

4. EXPERIMENTAL REPORT

(I) Method:

Fatigue test, coiling test and sag resistance test were conducted with respect to the following test steels 1 and 2.

Chemical compositions, ratios ($\sigma_{0.2}/\sigma_B$) and prior austenite grain size numbers of Test steels 1 and 2 are as follows:

Table 1 Chemical compositions (mass%)

	C	Si	Mn	Cr	Al	Ni	V	Mo	Nb	Fe and impurities
Test steel 1	0.60	2.16	0.50	1.76	0.003	0.2	0.3	—	—	Balance
Test steel 2	0.60	2.16	0.50	1.76	0.003	0.2	0.3	—	—	Balance
Claim 1	0.53	1.2	0.2	1.4	>0	>0	>0	0.05	0.05	Balance
	−0.68	−2.5	−1.5	−2.5	−0.05	−0.4	−0.4	−0.5	−0.5	

Table 2 Ratios ($\sigma_{0.2}/\sigma_B$) and Grain size numbers

	Ratio ($\sigma_{0.2}/\sigma_B$)	Grain size number of prior austenite
Test steel 1	0.65 *	12.5
Test steel 2	0.81	14.5 *
Claim 1	0.67−0.85	11.0−14.0

Notes) $\sigma_{0.2}$ means 0.2% proof stress (Yield Strength), and σ_B means Tensile Strength.
The ratio ($\sigma_{0.2}/\sigma_B$) of Test steel 1 is below the lower limit of Claim 1.
The grain size numbers of Test steels 1 and 2 were measured by 0.5 JIS grain size number.
The grain size number of Test steel 2 is over the upper limit of Claim 1.

The fatigue test was conducted until breakage or up to 100×10^5 cycles with respect to Test steels 1 and 2 respectively under a load stress of 760 ± 637 MPa at a temperature of 120°C.

The coiling test was conducted with respect to Test steels 1 and 2 respectively according to JIS G 3560, in which each number of cycles of windings was 10.

The sag resistance test was performed by measuring residual shear strain calculated from the difference of sag before and after fastening Test steels 1 and 2 respectively under a load stress of 1372 MPa for 48 consecutive hours at a temperature of 120°C.

(Ⅱ) Results

The results of fatigue test, coiling test and sag resistance test are shown in Table 3.

Table 3 Results of fatigue test, coiling test and sag resistance test

	Fatigue life ($\times 10^5$ cycles)	Coiling test	Residual shear strain (%)
Test steel 1	100	No breakage	0.285
Test steel 2	85	Breakage	0.155
criteria	≥100	No breakage	≤0.2

(Ⅲ) Criticality of Ratio ($\sigma_{0.2}/\sigma_B$)

Test steel 1 has a chemical composition and a grain size number which are within the range of Claim 1, but has a

smaller ratio ($\sigma_{0.2}/\sigma_B$) which is below the lower limit of Claim 1. The smaller ratio ($\sigma_{0.2}/\sigma_B$) of 0.65 leads the inferior sag resistance to the present invention.

On the other hand, the test steel demonstrated in the 132 Declaration submitted on December 22, 2009 (hereinafter, referred to as "Previous test steel") has the same chemical composition as Test steel 1 has, and has a grain size number of 12.0 within the range of Claim 1. But Previous test steel has a larger ($\sigma_{0.2}/\sigma_B$) of 0.861 which is over the upper limit of Claim 1. This larger ratio ($\sigma_{0.2}/\sigma_B$) leads the inferior fatigue life up to 80×10^5 cycles.

Therefore, Test steel 1 and Previous test steel indicate the criticality of the claimed ratio ($\sigma_{0.2}/\sigma_B$).

(IV) Criticality of Prior austenite grain size number

Test steel 2 has the same chemical composition as Test steel 1 has, and has a ratio ($\sigma_{0.2}/\sigma_B$) within the range of Claim 1. But Test steel 2 has a larger prior austenite grain size number which is over the upper limit of Claim 1. The larger prior austenite grain size number of 14.5 leads the inferior fatigue life and workability to the present invention.

On the other hand, Example No. 10 in the specification has a chemical composition (presented as "H2" in the specification) and a ratio ($\sigma_{0.2}/\sigma_B$) which are within the range of Claim 1, but has a smaller prior austenite grain size number of

10.5 which is below the lower limit of Claim 1. The smaller prior austenite grain size number of 10.5 leads the inferior fatigue life of 31×10^5 cycles and sag resistance represented by 0.250 of Residual shear strain to the present invention.

Therefore, Test steel 2 and Example No. 10 indicate the criticality of the claimed prior austenite grain size number.

The undersigned Petitioner declares further that all statements made herein of her own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Further declarant saith not.

Respectfully submitted,

Date: April 1st, 2011

Sumie Suda

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